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AFRICA RISING - Enhancing partnership among Africa RISING, NAFAKA and TUBORESHE CHAKULA Programs for fast tracking delivery and scaling of agricultural technologies in Tanzania Annual Report

01 October 2017 – 30 September 2018

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Transforming African Agriculture

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Overview of key activities implemented in 2017/18.

I. ACTIVITY OVERVIEW/SUMMARY

Activity Name:	AFRICA RISING - Enhancing partnership among Africa RISING, NAFAKA, and TUBORESHE CHAKULA Programs for fast tracking delivery and scaling of agricultural technologies in Tanzania.
Activity Start Date:	1 October 2017
Activity End Date:	30 September 2020
Name of Prime Implementing Partner:	International Institute of Tropical Agriculture (IITA)
Contract/Agreement Number:	BFS-G-11-00002
Name of Subcontractors/Sub awardees:	• Agricultural Research Institute (ARI), Dakawa/Chollima • Agricultural Research Institute (ARI), Hombolo • Agricultural Research Institute (ARI), Uyole • International Center for Tropical Agriculture (CIAT)
Major Counterpart Organizations	• District Agricultural Councils
Geographic Coverage (districts, regions, and/or Zanzibar)	• Babati District (Manyara Region) • Wanging'ombe District (Njombe Region) • Kilombero District (Morogoro Region) • Iringa Rural, Mufindi and Kilolo Districts (Iringa Region) • Mbarali District (Mbeya Region) • Mbozi and Momba Districts (Songwe Region)
Reporting Period:	01 October 2018 – 30 September 2018

1.1 Executive summary

The Africa RISING-NAFAKA partnership project focuses on the delivery and scaling of promising interventions that enhance agricultural productivity in Tanzania. The key interventions are the promotion of climate-smart agricultural innovations, dissemination of best-bet crop management packages, rehabilitation and protection of natural resources, and reduction of food waste and spoilage. The project focus is on three crop enterprises—maize, rice, and legumes (common bean, chickpea, cowpea, and green gram)—with nutrition and postharvest handling as cross-cutting themes. The key partners in the project include one USAID-funded project under the Feed the Future (FtF) Initiative in Tanzania—CMSD/NAFAKA, National Agricultural Research Institutions (Dakawa, Hombolo, and Uyole), District Councils, the International Center for Tropical Agriculture (CIAT), as well as the private sector (agro-input companies, millers, and processors). During the past year, project activities were implemented in eight districts in the regions of Iringa, Manyara, Mbeya, Morogoro, Njombe, and Songwe, all in the FtF Zone of Influence (ZoI).

Project activities were implemented in 156 villages located in the eight districts. These included the following: (i) establishment of 205 mother demonstration (demo) plots, 114 for maize/legumes, 45 for rice, and 46 for common beans; the demo plots act as learning sites for farmers; (ii) training 232

Government extension staff (183 male, 49 female) and 35,855 farmers (21,420 male, 14,435 female) on Good Agricultural Practices (GAPs); management of the fall armyworm; natural resource management; postharvest management; and community nutrition; (iii) support to production of quality declared seeds (QDS) for legumes (56 farmers planting 31.4 ha) and rice (107 farmers growing 40.4 ha). About 205 t of QDS (186 t for rice and 19 t for beans) were produced. For the QDS producers, activities towards strengthening their associations were initiated so that they can access services after the end of the projects (Africa RISING and NAFAKA). More of these activities will be implemented next year.

Other activities implemented included:

i. conducting field days and participating in the nane nane agricultural shows. Forty-five field days were conducted in six districts with 3,821 participants (2,442 male, 1,379 female) and various partners in attendance whereas the nane nane show which was jointly implemented with other USAID implementing partners was attended by 507 visitors (382 male, 125 female).
ii. conducting two studies on farmers' knowledge of grain standards (100 respondents) and on the impact of demos/seed packs on farmers' decisions to purchase agro-inputs (844 respondents). Results of the knowledge study indicate very low levels of knowledge among them on grain standards (only 1% of project farmers are knowledgeable). Results from the impact study indicate that a farmer who has access to a demo or to both a demo and small pack is 10% more likely to purchase agro-inputs.
iii. integrating ICTs in agriculture for better scaling. The Mwanga Platform provides services on agronomy, weather, and markets. The GIS component focuses on development of technology recommendations that will contribute to spatial targeting of the technologies.
iv. developing training materials for all the project components that will be used by partners for better scaling of the technologies.

Yield data were collected and analyzed with advantages shown in respect of the technologies promoted: improved varieties of rice (TXD306 and Komboka) yielded 7.1–7.9 t/ha with the use of fertilizers and GAPs compared with 4.8–5.7 t/ha for local varieties. For salt-affected soils (SAS) the salt-tolerant rice varieties (SATO1 and SATO6) yielded 6.5–9.1 t/ha compared with 3.2–7.3 t/ha for non-tolerant local varieties. In sub-humid areas where farmers were applying fertilizers before project inception, maize yields varied from 4.9 to 5.9 t/ha with recommended practices compared with 3.7–5.1 t/ha with farmers' practices, depending on maize variety. In semi-arid locations, yields of improved varieties with recommended practices (fertilizer use, water management) varied between 3 and 3.8 t/ha compared with 2.4 t/ha for improved varieties but with no other GAPs. Further, a yield difference of about 200 kg/ha was noted at sites treated with lime and fertilizers compared with sites where only fertilizers were applied.

The key challenges faced by the project during the reporting period were (i) fall armyworm; (ii) unfavorable weather (poor rains, flooding); (iii) poor market prospects for maize producers; and (iv) the need to achieve the balanced representation of women in Training of Trainers' workshops that was not always obtained. The budget for the reporting period was US$1,000,000 and the actual expenditures are reported separately in the financial report.

1.2 Summary of results to date

Indicators	FY 17/18 target	Q1 FY17/18	Q2 FY17/18	Q3 FY17/18	Q4 FY17/18	Achievements FY 17/18	Percentage achieved FY18	LOP target	LOP achievements to date	LOP percentage achieved
EG.3-1: (4.5.2-13) Number of households benefiting directly from USG interventions (RAA)	30,000	223	22,916	7,658	175	30,972	103.24	54,000	30,972	57.36
EG.3.2-1: (4.5.2-7) Number of individuals who have received USG-supported, short-term agricultural sector productivity or food security training (RAA) (WOG)	35,155	363	22,601	12,939	204	36,107	102.71	62,500	36,107	57.77
EG.3.2-4: (4.5.2-11) Number of for-profit private enterprises, producers' organizations, water users' associations, women's groups, trade and business associations, and community-based	128	85	77	20	-	182	142.18	250	182	72.8

organizations (CBOs) receiving USG food security-related organizational development assistance (RAA) (WOG)										
EG.3.2-17: (4.5.2-5) Number of farmers and others who have applied improved technologies or management practices with USG assistance (RAA) (WOG)	20,000				31,912	31,912	159.56	38,000	31,912	83.9
EG.3.2-18: (4.5.2-2) Number of ha of land under improved technologies or management practices with USG assistance (RAA) (WOG)	35,000				31,678.86	31,678.86	90.51	56,000	31,678.86	56.57

1.3 Evaluation/assessment status and/or plan

Assessment Type	Planned for (date)	Status
Project annual outcome survey	September 2018	Completed

2. ACTIVITY IMPLEMENTATION PROGRESS

2.1 Progress narrative

Africa RISING and partners are involved in the delivery of agricultural information and technology packages through a network of projects and other public and private sector actors including ACDI/VOCA that leads NAFAKA, the USAID-funded cereals project in Tanzania. These collaborations are aimed at improving efficiency and enhancing disciplinary integration while contributing to the goals of the Global Food Security Strategy (GFSS) of harmonizing regional efforts to fight hunger and poverty in countries with chronic food insecurity and insufficient production of staple crops. Attractive interventions in this project include promotion of climate-smart agricultural innovations, dissemination of GAPs, rehabilitation and protection of natural resources, and postharvest management.

The project focuses on three crop enterprises (maize, legumes, and rice) with postharvest handling and nutrition as cross-cutting themes. The key partners in the project include the International Institute of Tropical Agriculture (IITA) as the Lead institution, the International Center for Tropical Agriculture (CIAT), three institutions of the Tanzania Agricultural Research Institute (TARI)—Dakawa, Uyole, and Hombolo—and one USAID-funded cereal crops project, NAFAKA (led by ACDI/VOCA). These work in partnership with the District local government institutions, specifically DAICOs, the private sector (seed companies, millers, and processors) and NGOs to deliver on the following objectives.

i. Introduce and promote improved and resilient varieties of food crops to farm households in a manner that complements their ongoing farm enterprises, contributes to sustainable agricultural resource management, and offers nutritional advantages and alternative market channels.
ii. Disseminate GAPs along with the most promising new crop varieties suited to widely representative agroecological zones and market proximity.
iii. Protect land and water resources and foster agricultural biodiversity through the introduction of soil and water management practices.
iv. Introduce and promote postharvest management technologies for maize, rice, and legumes to reduce losses and bring quality up to market standards.
v. Offer and expand capacity-building services to members of grassroots farmers' associations, platform partners, and development institutions in the scaling process, paying particular attention to the special opportunities available to women farmers as technical and nutritional innovators and resource managers.

The project is currently being implemented in six regions in Tanzania, Manyara, Njombe, Morogoro, Iringa, Mbeya, and Songwe, all in the FtF ZoI (Fig. 1).

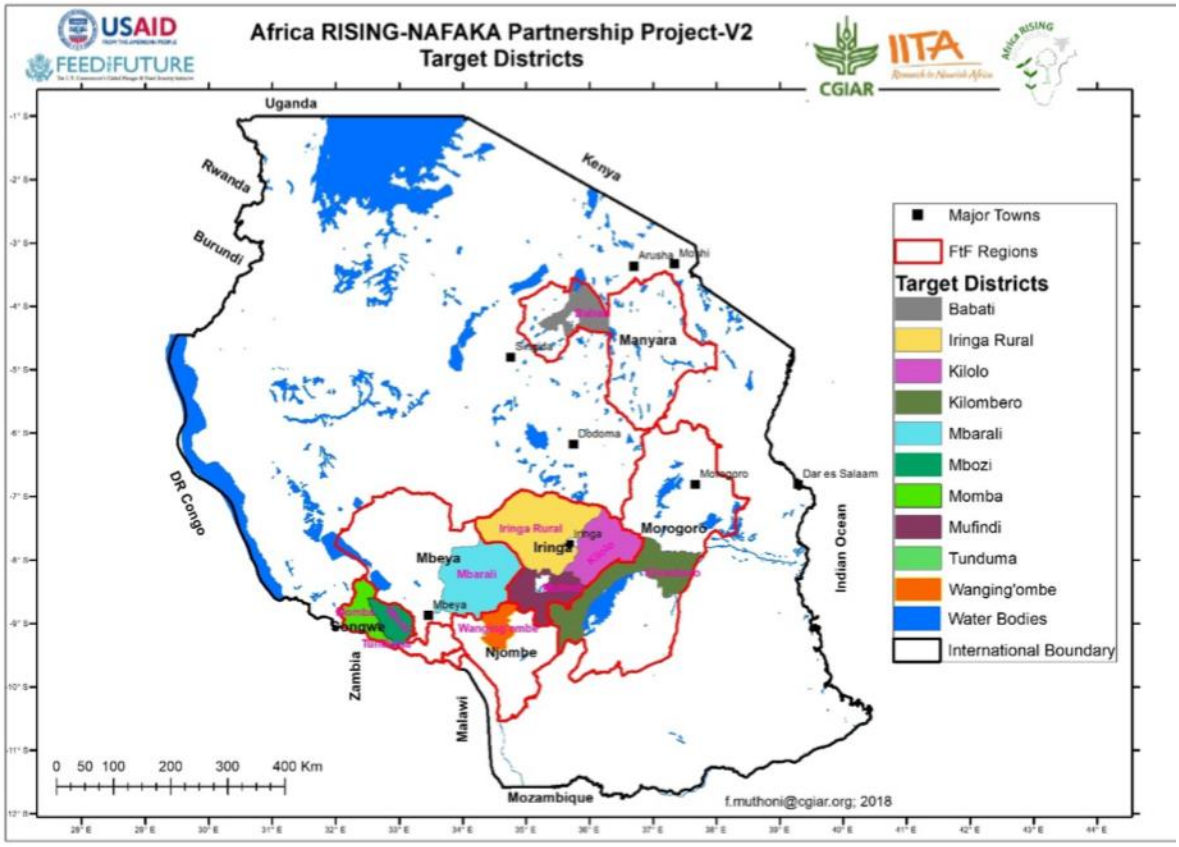


Figure 1. Project locations.

All project activities contribute to the Development Objective (DO2) of the USAID Tanzania Country Development Cooperation Strategy (CDCS), inclusive of broad-based economic growth being sustained. This is Year 1 of the second project phase and we plan to achieve the Life of Project (LoP) targets of 56,000 ha under improved technologies, 54,000 households benefiting from the project interventions, 62,500 beneficiaries trained, and 250 organizations benefiting from our project activities.

2.2 Implementation status and planned activities

2.2.1 Meetings with stakeholders

As this is Year 1 of the second phase of the project, a team of Africa RISING and NAFAKA staff met with partners to introduce the project in the new districts (Mufindi, Wanging'ombe, and Momba) but also to discuss modalities with partners in the old locations and any other issues necessary for successful implementation. The partners included District leaders and extension staff, agro-input companies, and farmers/farmers' organizations).

Photo 1. Africa RISING-NAFAKA project team hold a meeting with Mufindi DAICO Ms. Martha Kimambo. Photo credit: Japhet Masigo/IITA.

The meetings with farmers/farmers' organizations also constituted feedback on previous activities in the old project locations/districts. In addition to the provision of this feedback, discussions with farmers in the new project locations focused on technologies that have the potential to enhance productivity in their communities. Furthermore, there was the selection of demo sites in addition to the identification of innovations on which farmers would require further training.

At the end of the field visits, the maize team noted the management of soil fertility, moisture stress, and pests and diseases (especially the threat of fall armyworm), soil acidity in maize/legume areas (e.g., Kilolo District), GAPs, and postharvest handling as key areas of focus. The rice team identified selection of quality seeds, weed management, safe application and handling of chemicals, and GAPs as key areas of intervention.

2.2.2 Procurement of agro-inputs and establishment of demo sites

Agro-inputs for establishing demo and QDS sites were procured and delivered to all Districts. These included 4.1 t of rice, 809 kg of maize, 1.2 t of legumes (common beans and soybean) and about 16 t of fertilizers. In addition, seed companies—Meru Agro-seed company, and MAMS—partnered with the project to supply about 2.5 t of Africa RISING-approved maize varieties (hybrid QPM) for use in the scaling effort. Tables 1–3 indicate the different amounts of agro-inputs procured for demo sites in the project districts.

Table 1. Fertilizers (amounts and types) procured for CSA demo sites in Iringa and Songwe regions.

Fertilizer type	**Amount (kg)**
Yara cereal	5,750
Yara vera sulphan	5,000
Yara vera amidas	2,500
DAP	2,250
Urea	1,150
CAN	300
Rhizobia inoculants*	20
Total	**16,950**

Table 2. Seeds (types and amount) procured for CSA demo sites in Iringa and Songwe regions.

Maize		**Common Beans and Soybean**	
Seed variety	**Amount (kg)**	**Seed variety**	**Amount (kg)**
SC 719	160	Njano Uyole	400
Uyole Hybrid 6303	160	Uyole 303	200
PAN 691	252	Soybean seeds	600
Meru HB 513	60		
H 625	85		
DK 8031	60		
SEED CO 403	06		
SHOKA	06		
WH505	10		
DK8053	10		
TEGO	50		
Total	**859**		**1,200**

Table 3. Quantity and types of rice seeds distributed per district for demo sites

District	Types of seeds					
	SARO5 (TXD 306) (kg)	**Komboka (kg)**	**SATO1 (kg)**	**SATO6 (kg)**	**Legumes (kg)**	**Total (kg)**
Kilombero	1620	60	0	0	0	**1,680**
Mbarali	1420	120	16	16	0	**1,572**
Iringa Rural	420	60	16	16	0	**512**
Momba	305	30	0	0	0	**335**
TOTAL (kg)	**3,765**	**270**	**32**	**32**	**0**	**4,099***

*The amount of rice seeds distributed is high because of the need for farmers to test the new technologies by establishing 705 baby demos.

We established 205 demo sites for the different technologies because these are the main vehicle through which this project reaches smallholder farmers via training (Table 4).

Table 4. Mother demo plots established by the project.

District	Number of demos	Description
Iringa rural	29	Maize and rice. **Nine** have a combination of in-situ soil/water conservation, drought tolerant varieties, and fertilizers (N and P); **10** are for varieties and fertilizer; **eight** are for improved rice varieties (TXD 306 and Komboka) and fertilizers; **one** is for alternate wet and drying water management technology(AWD); and **one** is for AWD (rice) and legumes sequential cropping.
Kilolo	37	All maize. **30** are for soil fertility management (liming and fertilizer) and improved varieties; **seven** have a combination of in-situ soil/water conservation, varieties, and fertilizers.
Mufindi	15	Maize and legumes. **Nine** are for improved maize varieties and fertilizer (N and P); s**ix** are for improved bean varieties and fertilizer (P).
Wanging'ombe	9	All maize. Improved varieties and fertilizers (N and P), soil and water management.
Mbozi	50	Maize and legumes. **25** are for improved maize varieties and fertilizers; **25** are for improved bean varieties and fertilizers.
Momba	35	Maize, rice and legumes. **15** are for improved maize varieties and fertilizers; **15** are for improved bean varieties and fertilizers; **five** are for improved rice varieties (TXD 306 and Komboka) and fertilizers.
Mbarali	20	All rice. **16** are for improved varieties and (GAPs); **two** are for improved varieties, AWD and GAPs; and **two** are for SAS, AWD, and legume sequential cropping.
Kilombero	10	All rice. Improved varieties and fertilizers
Total	**205**	

2.2.3 Training activities

Two categories of training activities were conducted. The first was for Government extension staff, village-based advisors, and lead farmers on a variety of aspects, organized by Africa RISING and NAFAKA staff. In the first quarter, training activities were conducted, focusing on the use of different protocols for the establishment of demo sites. The number of trainees by type is shown in Table 5. The training activities were conducted according to agroecological zone and enterprise as enumerated below. For maize and legumes, these included:

i. Water harvesting technologies (ridging and tie ridging) for semi-arid areas of lower Kilolo, Iringa Rural, and part of Wanging'ombe District.
ii. Soil fertility management, liming, and control of soil erosion for areas with steep slopes (Kilolo).
iii. Use of drought tolerant and early maturing maize varieties such SC 403 and TEGO for areas with a shortage of rainfall, for example, in some villages of Iringa Rural and lower Kilolo District.
iv. Uses of pre-emergence and post-emergence herbicides for weeding in all districts.
v. Use of improved varieties of maize (Sc719, Sy 634, and UH6303) in Mbozi, Momba, Mufindi, and upper Kilolo.
vi. Use of pesticides for pest and disease control in maize or common bean in all zones.

For rice, the focus of the training was on the importance of planting improved rice varieties (SARO 5 (TXD 306), Komboka, SATO 1, and SATO 6), proper use of both basal and top-dressing fertilizers, and management of SAS as well as the collection of soil samples for analysis (this was only for new project locations). Trainees were also trained on how to use protocols to establish demo plots.

Table 5. Attendance of extension staff and lead farmers during training sessions.

Component	District	Male	Female	Total
Maize				
	Mbozi	53	30	83
	Momba	51	9	60
	Iringa Rural	21	10	31
	Kilolo	43	15	58
	Wanging'ombe	14	2	16
	Mufindi	11	6	17
Rice				
	Kilombero	17	6	23
	Iringa Rural	16	6	22
	Mbarali	32	10	42
	Momba	7	4	11
Total		**265**	**98**	**363**

Photo 2. A section of extension staff from Mbozi district being trained on calibration of a knapsack sprayer for controlling the Fall Army Worm (FAW). Photo credit: Japhet Masigo/IITA.

Farmers in Mikong'wi village, Iringa district, being trained on safe use of pesticides for controlling FAW. Photo credit: E. Majige/TARI Hombolo.

Photo 4 (left) and 5 (right). Farmers in Momba District being trained on proper planting of rice seedlings (recommended spacing of 20 cm x 20 cm). Photo credit: D. Kimaro/TARI Dakawa.

In the second quarter, in response to the outbreak of the fall armyworm (*Spodoptera frugiperda)* in Tanzania, the project organized training activities in January and February 2018 for lead farmers and extension staff from the districts of Kilolo, Iringa Rural, Mufindi, Wanging'ombe, Mbozi, Momba, Mbarali, and Kilombero. The focus of the training was on how

to scout for and identify the worm, appropriate control methods such as safe and correct use of pesticides, and cultural practices for managing the pests. After the training, the trainees embarked on a task of assisting project beneficiaries on scouting for the pests as well as providing technical advice on how to control the worm. Table 6 shows the distribution of trainees by district.

Table 6. Number of Government extension staff and lead farmers trained on management of fall armyworm.

District	Extension staff		Lead farmers	
	Male	Female	Male	Female
Iringa Rural	42	14		
Kilolo	32	6		
Mufindi	25	4		
Wanging'ombe	19	3		
Momba	17	3		
Mbozi	18	6		
Kilombero	16	6	14	5
Mbarali	14	7	12	8
Total	**183**	**49**	**26**	**13**

During the third and fourth quarters, training was provided on grain quality parameters for 191 leaders of producer organizations (153 male, 28 female) and 37 Government extension staff (31 male, 6 female) from Mbozi, Momba, Wanging'ombe, and Mufindi districts. The topics included sampling and assessment of quality; East African grain standards/specifications; moisture management; and postharvest aflatoxin management. The other training activity was on community nutrition for 19 community members (11 male, 8 female) drawn from among Village-based agricultural advisors (VBAAs) and Government extension staff in ten villages in Kilolo District and focusing on soybean processing and utilization.

The second category of training was for smallholder farmers, focusing on agronomy, pest and disease management, social and water management, harvesting and postharvest management, and community nutrition. This training was largely conducted by Government extension staff and VBAAs trained by the project. A total of 35,855 smallholder farmers were trained as shown in Table 7.

Table 7. Farmers trained on various topics in the management of rice, maize, and legumes.

District	Male	Female	Total
Iringa Rural	2,210	1,682	3,892
Kilolo	3,594	2,440	6,034
Kilombero	1,961	1,622	3,583
Mbarali	5,411	3,877	9,288
Mbozi	3,780	2,131	5,911
Momba	2,6981	1,305	4,003
Mufindi	1,099	787	1,886
Wanging'ombe	667	591	1,258
Total	**21,420**	**14,435**	**35,855**

2.2.4 Quality Declared Seed (QDS) production

One of the strong areas of focus for this project is to work closely with NAFAKA to strengthen access to and scaling of quality seeds; our focus is on rice and legumes (beans, common bean, chickpea, cowpea, and green gram). The project provided training to 131 QDS rice producers in Iringa (11), Kilombero (60), Mbarali (50), and Momba (10), and to 59 QDS common bean producers in Mbozi (21), Iringa Rural (13), Mufindi (19), and Kilolo (6). The training focused on GAPs for quality seed production as well as the requirements for certified seed production according to the guidelines of the Tanzania Official Seed Certification Institute (TOSCI). After the training, 107 producers were supported by the project to establish fields for rice (40.4 ha) and 56 for common beans (31.4 ha) leading to harvests of about 205 t of seeds (Tables 8 and 9).

Photo 6. Esther Mtandi, one of the QDS producers working with the Africa RISING – NAFAKA project tends to her farm at Mapogoro village, Iringa District. Photo credit: Filbert Mzee/ACDI VOCA.

Table 8. Amounts of QDS common beans produced and certified.

District	**Variety**	**Yield (kg)**
Kilolo	Njano Uyole	335
Iringa Rural	Njano Uyole	4,195
Mufindi	Njano Uyole	8,560
Mbozi	Njano Uyole, Uyole 03, Uyole 96	5,980
Total		**19,070**

Table 9. Amounts of QDS rice produced and certified (all TXD variety).

District	**Yield (kg)**
Kilombero	81,000
Mbarali	88,315
Mvomero	9,000
Momba	2,173
Iringa Rural	5,525
Grand total	**186,013**

An additional 22 farmers were supported to establish a QDS system for other legumes (6 ha/16 acres) in the rice farming system (Table 10) but the seeds had not matured by the end of the current year since the crop is normally planted after the harvesting of rice.

Table 10. QDS production for rice-legume sequential cropping during the current cropping year.

District	**Number of farmers**	**Acres**	**Crop(s)**
Kilombero	9	6	Chickpea, cowpea, and green gram
Iringa Rural	4	3	Chickpea, cowpea, and green gram
Mbarali	6	5	Chickpea, cowpea, and green gram
Momba	3	2	Chickpea, cowpea, and green gram
Total	**22**	**16**	

2.2.5 Field days and agricultural shows

Fifty field days were organized in partnership with District Councils and agro-input companies (Table 11). About 4,245 people (2,691 males, 1,554 females) attended in all the seven Districts where field day activities were organized. This was a well-coordinated effort which involved companies such as SeedCo, Yara, BASF, Syngenta, Monsanto, MeruAgro, and the Tanzania Fertilizer Association partnering and taking a key role in co-funding and co-facilitating the activities. As a result, the level of interaction between the field day participants was enriched. Participants, especially farmers, were able to share their experiences with the various technologies, including key challenges, with the researchers, development actors, local leaders, and agro-input companies. In addition, plans and strategies on how to enhance access to quality services such as seeds, agro-chemicals, markets, soil amendments, and extension were discussed during the field days.

Table 11. Participants at farmers' field days in the different districts.

Project component	District	Number of field days	Male participants	Female participants	Total
Maize/legumes/ postharvest	Iringa Rural	2	127	103	230
	Mufindi	2	192	196	388
	Wanging'ombe	1	78	91	169
	Momba	10	415	200	615
	Mbozi	18	1,272	667	1,939
Rice/legumes/ postharvest	Iringa Rural	5	154	53	207
	Mbarali	7	200	106	306
	Kilombero	3	180	114	294
	Momba	2	73	24	97
Overall total		50	2,691	1,554	4,245

Photo 7. Farmers and other stakeholders attending a field day event at Idete village, Kilombero disctrict. Photo credit: D. Kimaro/TARI Dakawa.

Photo 8. Africa RISING-NAFAKA project coordinator, Mbozi District, Ibrahim Mkwiru explains how PICS storage bags work to a visitor to the project exhibition booth at the nane nane agriculture fair which was held at Mbeya show ground on 1 – 8 September 2018. Photo credit: Haroon Sseguya/IITA.

In addition, during the nane nane week (1–8 August) Africa RISING-NAFAKA co-participated with other USAID IPs in Mbeya Region to showcase innovations that can improve livelihoods and contribute to national development. A total of 507 participants (382 male, 125 female) visited our stall in Mbeya, including 38 Government officials and 65 private sector/NGO actors.

The following technologies were exhibited:

- Maize shellers of different capacities (ranging from 0.5 to 3.5 t/ha),
- Collapsible dryer case for improved drying of grain,
- Hermetic storage bags (PICS, Agro Z, and Grain pro bags),
- Aflasafe technology for pre-harvest aflatoxin management,
- Value-added products of maize, rice, spices, and banana,
- Improved rice varieties, and
- QDS for paddy.

2.2.6 Production of training materials

One of the focus areas for this phase of the project is the development and refinement of training materials and documentation products that will be used for the further scaling up of technologies. To this end, we embarked on development of a variety of materials, as follows.

1. Rice production manual and users' notes
2. Maize production manual and facilitator guide
3. Common bean production manual and facilitator guide
4. Soil and water management manual and facilitator guide
5. Postharvest and nutrition-related training materials under the following titles:

    i. Trainers' manual
    English title: *Maize quality standards and specifications: A trainers' manual for smallholder farmers in Tanzania.*
    Swahili title: *Viwango vya Ubora wa Mahindi na Ufafanuzi: Mwongozo wa mwezeshaji kwa wakulima wadogo nchini Tanzania.*

    ii. Aflatoxin brochure
    English title: *Brief overview on aflatoxin.*
    Swahili title: *Ukweli Kuhusu sumukuvu.*

    iii. Aflatoxin fact sheet
    English title: *All about aflatoxin: What it is, its effects, and how to control it.*
    Swahili title: *Ijue sumukuvu: maana, athari na udhibiti wake.*

    iv. Trainers' manual
    English title: *Postharvest operations and quality specifications for rice: A trainers' manual for smallholder farmers in Tanzania.*
    Swahili title: *Uendeshaji wa Shughuli za Baada ya mavuno na Vipimo vya Ubora kwa Mchele: Mwongozo wa mwezeshaji kwa wakulima wadogo nchini Tanzania.*

    v. Recipe book
    English title: *Soybean utilization for improved household nutrition: A compendium of common soybean recipes.*
    Swahili title: *Matumizi ya soya katika kuboresha lishe ya kaya: Mkusanyiko wa mapishi mbalimbali.*

Materials will undergo further refinement through pre-testing and translation into Swahili (for any not already translated) and be used in the following year.

2.2.7 Yield data

Data on the effect of five technology packages were collected from the mother demos. For rice, the package of use of improved varieties, fertilizers, and other GAPs indicated that, as for previous years, improved varieties led to higher yields than local varieties with or without fertilizers and other GAPs. With prilled urea (PU), Urea super granules (USG), and other GAPs the average yield of improved varieties across sites ranged between 7.1 and 7.9 t/ha compared with 4.8 – 5.7 t/ha for the local varieties (Fig. 2). With other GAPs only (i.e., without fertilizers) improved varieties yielded 4.5 – 4.6 t/ha while local varieties yielded 3.5 t/ha. The

second package for rice was management of SAS whereby SATO varieties are being promoted together with GAPs. Results indicated higher yields from the SATO varieties (6.5 – 9.1 t/ha) compared with non-tolerant local varieties (3.2 – 7.3 t/ha) with or without GAPs (Fig. 3). The results once again prove that rice farmers could increase productivity by adopting the improved varieties and the accompanying GAPs.

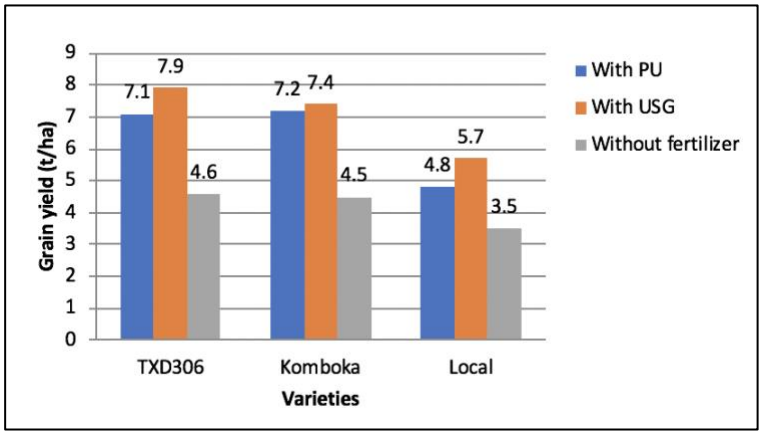


Figure 2. Grain yield of improved and local rice varieties grown with or without two nitrogenous fertilizers and other good agricultural practices (GAP) across mother demonstration sites.

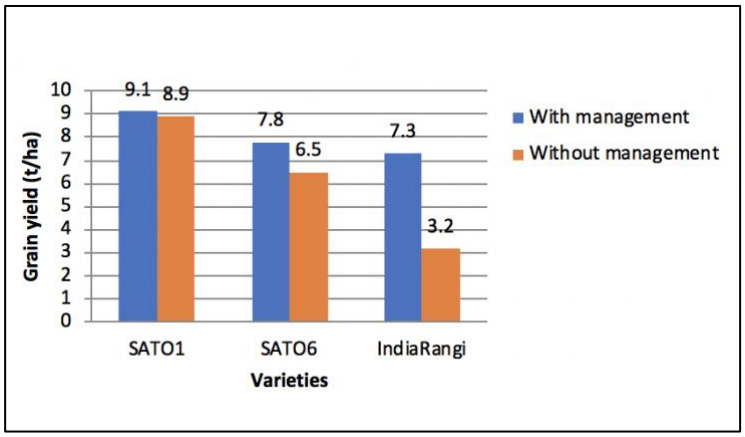


Figure 3. Grain yield of two salt-tolerant and one non-tolerant rice varieties grown with or without salt management and other good agricultural practices (GAP) in a mother demonstration field at Ruiwa irrigation scheme, Mbarali.

For maize, the first technological package was on optimizing fertilizer use on different varieties. In Mbozi and Kilolo, where most farmers were already using fertilizers at project inception, the demo was on optimizing the use of YARA® fertilizers on different varieties in three splits (recommended practice) as opposed to applying fertilizer in two splits (farmers' practice). Data from the demos showed an increase in yield of between 500 and 1200 kg/ha depending on the variety (Table 12) with the recommended fertilizer application. There were, however, huge variations in yields among sites, largely due to the soil fertility status and the way in which demos were managed (time of planting, timing of weeding, and pest control).

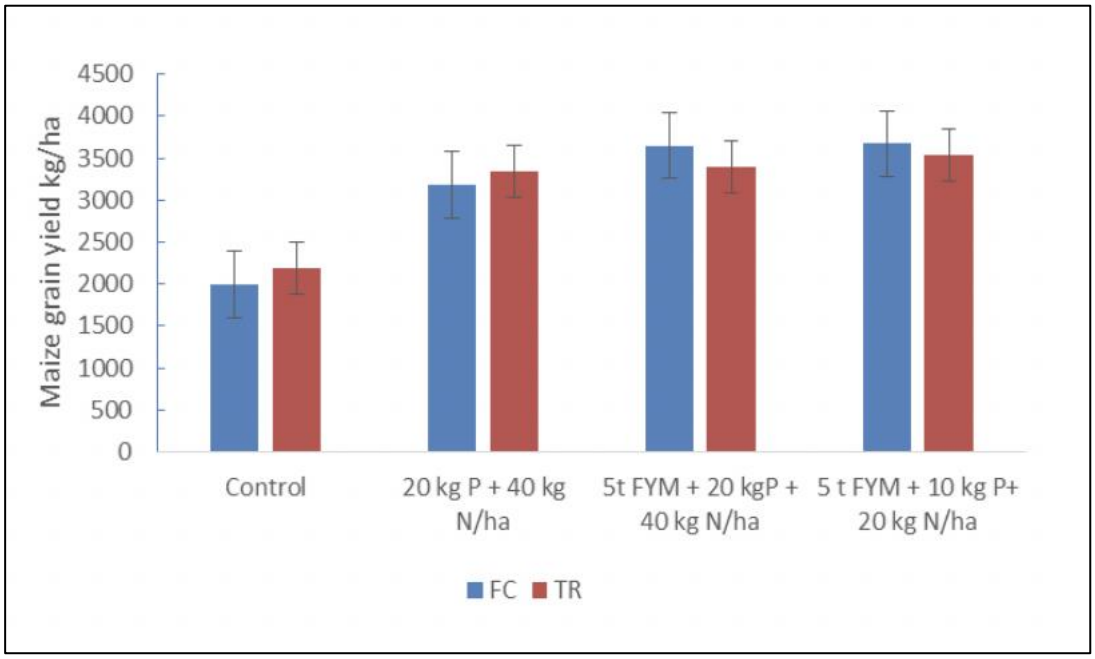
Table 12. Yield performance of different maize varieties as affected by amount of fertilizers applied on the maize, averaged by District.

District	Fertilizer application method or Treatment	Maize variety and yields (kg)			
		PAN 691	SC 719	SY 634	UH 6303
Mbozi *(n = 25)*	Half dose (FP*)	5,105	4,656	3,792	4,353
	Full dose (RP**)	5,749	5,857	4,924	4,894
	Mean	5,427	5,257	4,358	4,623
	LSD	*522.6*			
Momba *(n = 15)*	FP	4,723	5,119	3,956	4,859
	RP	5,829	6,188	4,600	6,124
	Mean	5,276	5,653	4,278	5,491
	LSD	*451.1*			

*FP = farmers' practice; farmers apply fertilizer in two splits, at planting and at 3 weeks after emergence.
** RP = recommended practice; apply fertilizer in three splits, at planting, top-dress 3 weeks after emergence, then at tasselling or cob filling stage. Fertilizers used are YARA Mira cereal NPKSMgZn (23:10:5:3:2:0.3 – in %) at planting, then Yara Vera Amidas NS (40:5 in %) and Yara Vera Sulfan (24:15 in %) in one or two splits.

Overall, the recommended practice led to higher yields. It should be noted however, that the yields between the two practices were confounded by the damage caused by the fall armyworm.

The first component of the second maize-based technology package was on the integration of soil fertility management options with tillage methods in semi-arid locations of Iringa Rural and Wanging'ombe districts. These included application of diammonium phosphate (DAP) fertilizer at planting stage based on a P application rate of 20 kg/ha top-dressed with urea at 40 kg N/ha; use of farm yard manure (FYM) at 5 t/ha top-dressed with a half rate of N at 20 kg/ha; use of tied ridging to conserve soil water or flat cultivation (FC), and combinations of the tillage methods and soil fertility management. The yield advantage obtained from optimal use of mineral fertilizers ranged between 25.5 and 49% over conventional farmer practices, i.e., FC without fertilizers (Fig. 4). Interestingly, use of tied-ridging alone without fertilizers gave a yield advantage of 25.5% over FC. The effect of tillage did not feature out as expected because of heavy rains received in March; this led to excess water ponding that in turn was reflected in poor performance of the tied ridging technology.



*FC = Flat cultivation/conventional farmers' practice; TR = Tied ridging tillage method.

Figure 4. Maize grain yield (kg/ha) as affected by tillage method and fertilizer application during 2017/2018 cropping season in semi-arid areas (Iringa DC).

The second component of the second technology package was for the sub-humid areas of Kilolo, Mufindi, and Iringa Rural Ddstricts. By the end of this quarter, harvesting had been completed only in Kilolo District. Accordingly, FC in combination with 5 t/ha of FYM applied with 10 kg P/ha and 20 kg N/ha registered the highest yields (Fig. 5). Although there were no significant statistical differences among treatments, the importance was noted of conserving water with tied ridges when a full dose of inorganic fertilizers was used.

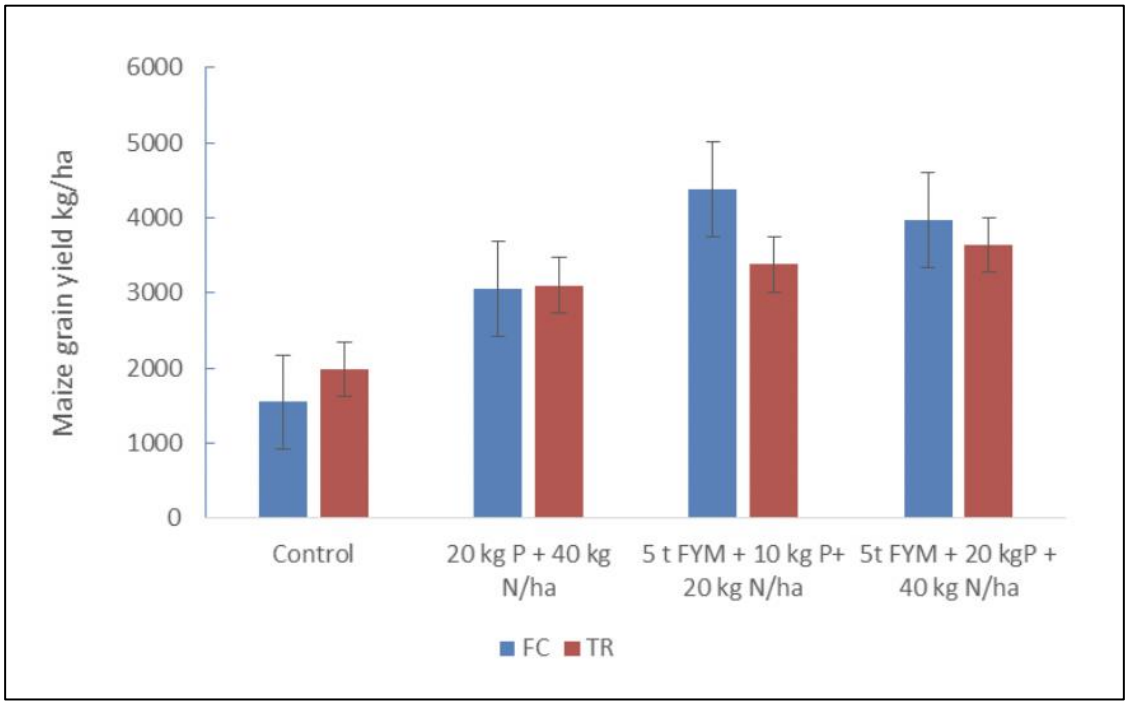


Figure 5. Maize grain yield as affected by tillage methods and fertilizer types and rates during 2017/2018 cropping season in sub-humid areas (Kilolo).

Moreover, the benefit of combined use of organic and mineral fertilizers was clearly demonstrated. It was also clearly shown that application of moderate rates (5 t/ha) of FYM, which is within the reach of most livestock keepers, can cut down by half the cost of mineral fertilizers and achieve the same yields as those obtained by applying the full rates of recommended P and N fertilizers.

The third technology package for maize focused on the effect of lime application. Farmers in some of the project locations had complained about the low yields below the potential of the maize varieties despite their use of all the GAPs; the cause was traced to the acidity of soils. Demos on the importance of liming to increase fertilizer use efficiency were tested in fields with acidic soils in Kilolo District. Lime was applied in combination with two common fertilizer application regimes: (i) YARA® Mira Cereal (NPKSMgZ) (23:10:5:3:2:0.3) applied in three equal splits (at planting, at 3 weeks after emergence, and finally at tasselling; and (ii) DAP at planting top-dressed with urea 3 weeks after emergence.

Although application of lime and fertilizers had no significant effect on maize grain yield during 2017/2018 cropping season, the treatments with lime exhibited slightly higher yields compared with those without lime (Fig. 6). From the literature, the effects of lime are not immediate. Nevertheless, the results for the first season are promising. and we plan to continue with this lime technology for the next two seasons at the same demo sites.

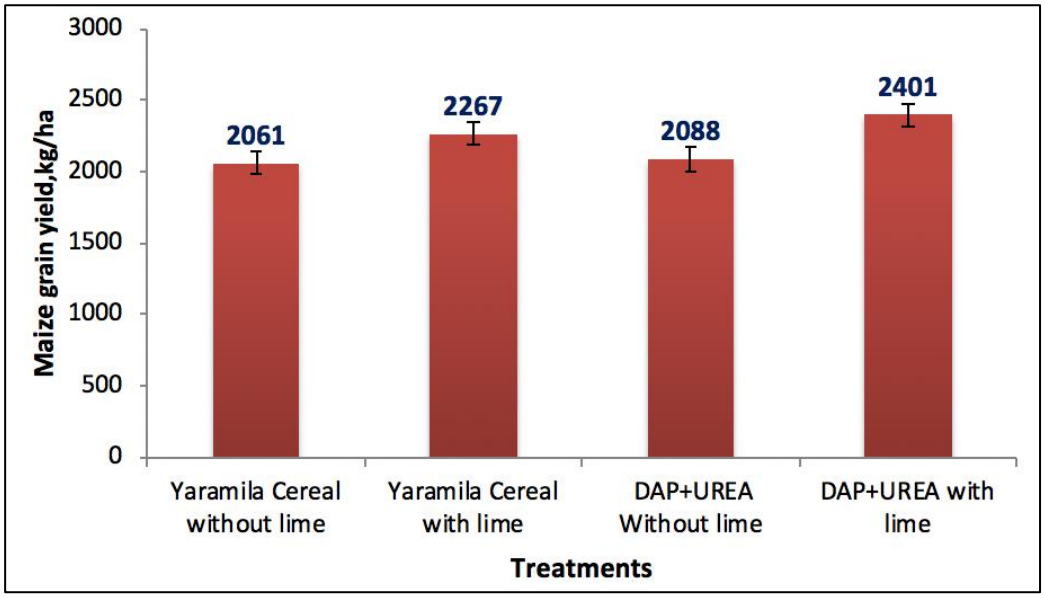


Figure 6. Maize grain yield as affected by application of lime and fertilizers during 2017/2018 cropping season in Kilolo District.

2.2.8 Integration of ICTs

The project launched the MWANGA Platform in 2017 as an ICT empowering tool to provide advice to smallholder farmers on agronomy, marketing, and climate services. During the reporting period, the Platform was updated, and the plan was to link about 30,000 beneficiaries of the project to the ICT app. Processing of the names and contact details of beneficiaries will be finalized in the early quarters of next year. The ICT services focus on improving soil fertility, providing better agronomic management, and using improved seed varieties coupled with better and judicious utilization of agricultural inputs such as fertilizers as well as effective management practices for soil and water resources. These interventions act as "Best Management Practices" (BMPs) that result in increased system productivity within smallholder farming in Tanzania to promote technologies beyond the project target sites.

By the end of the year, an app, UKULIMA IQ, which characterizes the Platform was developed; it can be accessed at the link below and will provide opportunities for both written and audio-visual services:
https://play.google.com/store/apps/details?id=com.pondipb.pondibrian.ukulimaiq&rdid=com.pondipb.pondibrian.ukulimaiq

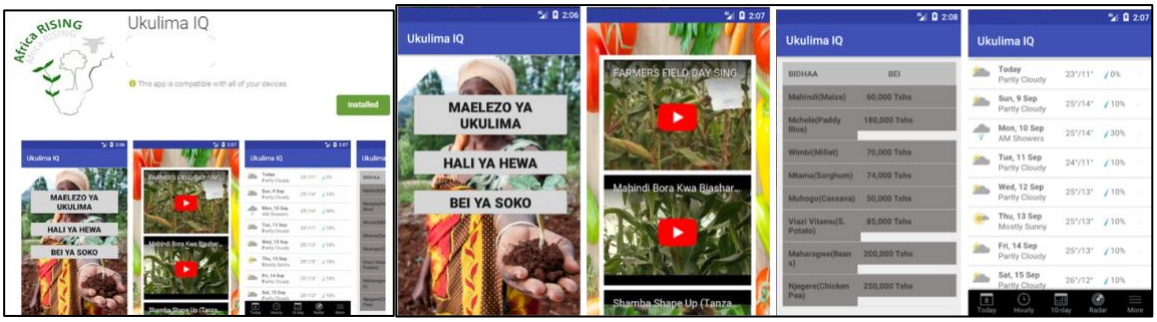


Photo 9. Screen shots of the Ukulima IQ App.

We also engaged with existing actors in ICTs for agriculture in Tanzania, and these are elaborated in section 3.5 on sustainability.

Use of GIS for better scaling is another IT component of the project. During the current year, we mapped long-term spatial-temporal trends in rainfall to identify locations experiencing downward or upward trends. The maps will guide targeting of appropriate climate smart agricultural technologies. Three BSc students (two from Ardhi University Tanzania, and one from Wageningen University, the Netherlands) undertook industrial attachment in the project plus one graduate intern from University of Twente, the Netherlands. A draft training manual for disseminating recommendation domains for project technologies to was developed, and this be used for the training of Government extension staff and other extension agencies.

2.2.9 Meetings

To monitor implementation progress and review achievements, two review meetings were conducted. The first involved the implementing institutions and was held on 12 April 2018 in Iringa town. Overall, good progress was noted by all teams, but it was suggested that some aspects need to be addressed. These include strengthening QDS producers' organizations (Q-POs) as a means of ensuring the sustainability of community-based seed production; more participation in the SAGCOT activities; conducting a refresher training (boot camp), for all staff involved in the project before the beginning of next season; and finalization of training materials.

The second meeting was a stakeholders' annual review and planning meeting held from 26 to 27 June 2018 in Dar es Salaam. Participants came from among the implementing institutions (IITA, CIAT, District Councils, TARI, and the Ministry of Agriculture) as well as the donor (USAID). Results of the progress made so far were shared and each team presented their plans for the 2018/19 financial year. One key observation during the meeting was that the project needs to recast the scaling approach to ensure that more women and young people are reached, and the teams should ensure that activities focus on all the project objectives as stated in the proposal. To this effect, generic templates and strategies that will be used to ensure delivery on all objectives were developed and shared with the teams. Teams were also urged to integrate lessons learned in the remaining project period. Proceedings of the annual review and planning meeting are available at this link: http://africa-rising-wiki.net/Ar-nafaka_rev_planning_June2018

2.2.10 Studies

The project team conducted two studies. First, an Africa RISING-NAFAKA joint study on the impact of demos/seed packs on farmers' decisions to purchase agro-inputs was conducted in the districts of Kongwa, Mvomero, Kilolo, and Iringa Rural. Respondents included those who had participated in the AR-NAFAKA project (444) and those in the Districts (different, non-contiguous villages) who had never participated in the project (422) —all selections were random. Using propensity score matching methodology for analysis, our preliminary results indicate that, for those who participated only in demos, there is an 11.5% likelihood of purchasing agro-inputs whereas for those with access both to demos and small packs, the likelihood is 13.1% when compared to those in control villages. We will continue with further analysis of the data to tease out explanatory variables.

Another study was conducted on postharvest knowledge and the needs of project beneficiaries, targeting 100 randomly selected respondents drawn from the districts of Iringa Rural, Mbozi, and Kilolo, Mbarali, and Mvomero. Results indicate that the level of knowledge about grain quality standards was very low; the majority (90.4%) were unaware of any quality standards for rice and had not received any training on grain quality specifications. Only 3.8% of respondents were aware of the specifications by Tanzania Bureau of Standards. About two-thirds of farmers (63%) did not grade their produce. In the handling of paddy, moisture management was ranked as a very important parameter by half of the respondents (51%) whereas about one-quarter (23%) ranked moisture management as not being important. The presence of organic foreign matter was not important to 42.3% of respondents. Similarly, the presence of inorganic matter (soil, sand, stones/gravel) was not important or of little importance to 64.4% of respondents: it was very important to 14% of them. Presence of chaff

was not important or was of little importance to 66% of respondents. Breakage of kernels was important to 39% of respondents; whereas pest damage was not important to 81% of respondents. These observations may be related to the fact that many farmers did not have knowledge of rice quality parameters; only 25% of respondents reported ever having been trained on rice quality. Results from both studies were used to design project interventions aimed at better quality services.

2.2.11 Problems and challenges

1. Fall armyworm destroyed maize fields especially in Mufindi and Mbozi districts. However, further damage was stemmed by the project's efforts (together with the NAFAKA project) of training Government extension staff, supporting providers of sprayer services, and working with the VBAA rural agro-dealer network to provide timely access to agro-inputs and advice.
2. Low production levels caused by the dry spell occurred and these affected the performance of common bean and maize fields in Iringa and Mbozi districts. In addition, we also realized that low investment was made by farmers in common bean seed production especially in the adoption of fertilizers, insecticides. and fungicides. Training on GAP for common bean was made. It was also realized that improved drought tolerant bean varieties need to be introduced in drought prone areas, and these will constitute one of the areas of focus in the year.
3. The market prices for maize have been low this year and this has affected some farmers' efforts to invest in improved technologies. The NAFAKA project has worked with other partners such as the East African Grain Council (EAGC) to explore rewarding market opportunities for farmers. The project has also put more emphasis on crop diversification to include legumes (beans and soybean) as an alternative source of income.
4. For postharvest activities (but also for some of the other components), a balanced representation by gender in Training of Trainers' (ToT) workshops was not always achieved. Also, active participation of women was low. This was partly because of low representation of women and the youth in village-level leadership positions. Another probable reason could be that women found it difficult to attend residential ToT workshops because of household chores. In future we will pay closer attention to attendance by women and the youth when inviting participants to training sessions and also be sensitive to the special needs of women during the training sessions. This could mean organizing separate shorter (one-day) workshops for women closer to village level, in which women would also feel more relaxed and confident to participate actively. However, this approach will also require extra resources. Thus, we will have to see how best to allocate resources against the potential benefits considering that more women than men actively participate in postharvest operations in grain value chains in Tanzania.

2.2.12 Planned activities

The key planned activities for next quarter include the following:

i. Procurement of agro-inputs and establishment of demo sites,
ii. Training of extension staff, VBAAs, Lead Farmers, and farmers,
iii. Conducting studies (e.g., willingness to pay for some services such as mechanization),
iv. Review and learning meetings,
v. Documentation of project achievements and lessons,
vi. Processing and sharing of yield data.

3. INTEGRATION OF CROSS-CUTTING ISSUES AND USAID FORWARD PRIORITIES

3.1 Gender equality and women's empowerment

The AR-NAFAKA project approach emphasizes gender consideration at all levels of project implementation. In the process of building capacities of farmers, both males and females were trained, considering different gender groups, i.e., adult males and females and the youth (of both sexes). Both male and female members have equal opportunities in the groups and efforts are being made to increase the number of females taking part as male participants constitute about 60% of project participants. There is still need to consider some measures to improve the participation of women and the youth in future trainings and other project activities.

3.2 Youth engagement

Youth involvement is a key aspect of the project interventions. The youth are equally encouraged to participate in all activities. During the reporting period, about 40% of project participants have been young adults under 35 years of age. The youth are also engaged as service providers for the application of agrochemicals and as artisans for postharvest technologies and QDS production.

3.3 Local capacity development

As in past years, the project continues to work with Government agricultural extension staff at District and Village levels. In addition, collaboration by Africa RISING and NAFAKA continues in supporting and training VBAAs who not only complement extension staff trainings but also play a key role as frontline actors in the rural agro-input dealer network. Furthermore, the project works with farmers' groups and associations whose capacities are developed in GAPs and related technical areas.

3.4 Integration and collaboration

The NAFAKA field staff coordinate the Africa RISING-NAFAKA partnership project activities supported by Africa RISING in all the project Districts (except Babati). In addition, we have successfully sought collaboration with the private sector (Syngenta, Seed Co, Meru Agro, Tanzania Fertilizer Association, and BASF) to support demo sites in all project Districts. The companies provided both inputs and technical support, and actively participated in organizing and implementing the field days. In addition, the preparation and delivery of the nutrition training included contributions from Center for Counseling, Nutrition and Health Care (COUNSENUTH). We also work with PPTL, Poly Machinery, and AgroZ companies for postharvest services.

3.5 Sustainability

The close collaboration with the District agricultural extension services and private sector actors aims at linking the farmers to partners and development initiatives that will provide support beyond the life of the project. In collaboration with the NAFAKA project, the team works with VBAAs and selected Lead farmers who manage demo plots, provide access to inputs, and produce QDS for legumes and rice to sustain the availability of varieties being taken to scale. Furthermore, the project team plans to continue linking local input and other service providers (e.g., machinery, crop insurance) with farmers and local extension staff to ensure the technologies continue to be accessible after the project ends. For ICT services, there are exploratory engagements with different private sector partners, namely ESOKO and Andre and Ross, towards improving the Platform, as well as closely working with TARI Uyole which already has a running ICT-Platform for agriculture led by CABI and Farm Radio International (FRI) through the Upscaling Technologies in Agriculture through Knowledge Extension (UPTAKE) project.

3.6 Environmental compliance

In accordance with the project PERSUAP and other guidelines, the team emphasizes the judicious use of agro-inputs by promoting integrated soil fertility management without damaging the natural resource base. In semi-arid locations we encourage farmers to use improved in-situ water conservation technologies, such as tied ridges. Management technologies for soils on steep slopes or those affected by acidity or high salinity and calcium content underlie the approach used in this project. Given the increase in problems of water availability for production, we emphasize the importance of using organic manure and minimizing the use of water in rice production. This is done, among other methods, by promoting the water-saving technologies such as the AWD technology and in establishing bunds around paddy plots in rice.

3.7 Global climate change

Since the project is operating in the context of climate change we have embraced scaling of technologies and agricultural practices that enhance resilience to climate variability.

3.8 Policy and governance support

The project's activities are in line with the Government's policy of fostering agricultural development. Consequently, the team has received tremendous support from National, Regional, District, and Village local governments in all areas where the project activities are implemented.

3.9 Private sector engagement, Public Private Partnerships (PPP), and Global Development Alliance (GDA) collaboration

The project works directly with three agro-input/seed companies in Tanzania—Syngenta, Seed Co, and BASF. Their staff have been instrumental in providing guidance on matters

related to agro-inputs as well as in participating in the rural agro-input network spearheaded by the NAFAKA project.

The demand for the mechanical shellers/threshers and hermetic storage bags is gradually increasing owing to the increase in awareness about the technologies. We established partnership with the Poly Machinery Co. Ltd, based in Dar es Salaam, that can supply mechanical shellers/threshers and provide spare parts and after-sales services to farmers. We also established partnerships with two manufacturers of hermetic storage bags, i.e., A to Z Textile Mills Ltd and PPTL Co. Ltd. The companies have shown interest in continuing to work with farmers and other supply chain actors to strengthen the supply network especially in the rural areas. This will enhance continuity of the use of the technology.

3.10 Science, technology, and innovation

Nothing to report this quarter.

4. STAKEHOLDER PARTICIPATION AND INVOLVEMENT

See sections 3.3 and 3.4.

5. MANAGEMENT AND ADMINISTRATIVE ISSUES

Japhet Masigo, the field liaison officer relocated to Iringa and Haroon Sseguya, the project coordinator, relocated to Mbeya NAFAKA office in September 2018 so they are able to coordinate better with the various partners instead of operating from Morogoro.

The rice team had Dr Didas Kimaro to replace Mr Ibrahim K. Paul who went for further studies; Dr Sophia K. Kashenge who was transferred from TARI to the Agricultural Seed Agency (ASA) is no longer part of the team. Thus, the new team composition for rice activities is as follows:

Name	Gender	Disciplinary expertise	Qualification	Project role
Charles Chuwa	M	Plant pathologist	PhD	Team leader/co-ordinator
Didas Kimaro	M	Breeder	PhD	Implementation
Joel Zakayo	M	Agronomist	MSc	Implementation
Ndimubandi Mvukiye	M	Agronomist	MSc	Implementation

There is no change for other staff.

6. MONITORING, EVALUATION, AND LEARNING

The PMP indicators are presented in Annex 1.

7. ANNEXES

7.1 Annex I. Performance against PMP indicators for Project Year III (2017/1)

Indicator / disaggregation	Target 2018	Qr1 (Oct–Dec 2017)	Qr2 (Jan– Mar 2018)	Qr3 (Apr–Jun 2018)	Qr4 (Jul – Sept 2018)
EG.3-1: (4.5.2-13) Number of households benefiting directly from USG interventions (RAA)	**30,000**	**223**	**22,916**	**7,658**	**175**
New/Continuing					
New		74	7,627	3671	79
Continuing		149	15,289	3987	96
Location					
Rural	30,000	223	22,916	7,658	175
Urban/Peri-urban					
EG.3.2-1: (4.5.2-7) Number of individuals who have received USG-supported, short-term agricultural sector productivity or food security training (RAA) (WOG)	**35,155**	**363**	**22,601**	**13,088**	**204**
Type of Individual					
Producers		223	22,489	12,939	204
Male		152	13,604	7,549	115
Female		71	8,885	5,390	89
People in Government		**132**	**100**		
Male		108	75		
Female		24	25		
People in private sector firms		**8**	**12**		
Male		5	7		

Female		3	5		
People in civil society					
Male					
Female					
EG.3.2-4: (4.5.2-11) Number of for-profit private enterprises, producers' organizations, water users' associations, women's groups, trade and business associations, and community-based organizations (CBOs) receiving USG food-security-related organizational development assistance (RAA) (WOG)	**128**	**85**	**77**	**20**	**-**
Type of organization					-
For-profit private enterprises			4	-	-
Producers' organizations		85	40	20	-
Water users' associations					-
Women's groups			33	-	-
Trade and business associations					
Community-based organizations (CBOs)					
EG.3.2-17: (4.5.2-5) Number of farmers and others who have applied improved technologies or management practices with USG assistance (RAA) (WOG)	**20,000**				31,912
EG.3.2-18: (4.5.2-2) Number of ha of land under improved technologies or management practices with USG assistance (RAA) (WOG)	**35,000**				31,678.86

7.2 Annex II: Success stories

Beyond being a food security intervention, PICS storage bags are giving Tanzania's smallholder farmers an edge where it counts—at the market gates

For Magdalena Haule and her fellow farmers from Itumpi Village, Mbozi District, in the southern highlands of Tanzania, the eureka moment came in January 2017 when they opened the first set of PICS storage bags to evaluate how their experiment had gone. To their astonishment, the maize they had stored in these air-tight bags for the past 6 months was in pristine condition! There was no sign of mold or the usual grain pests which they had grown accustomed to every time they stored their grain for long periods.

At the beginning of every year, maize becomes a premium commodity in markets across Tanzania due to low supply and high demand, so Magdalena and her fellow farmers knew this was the best time for them to cash in on the 4,600 kilograms (kg) of maize that they had stored as part of the experiment.

"We sold 1 kg of maize at TZS 800 (USD 0.35). If, for example, we had sold our maize in July/August 2016, we could have barely gotten TZS 500 (USD 0.22) for the same quantity because the market is flooded with maize. So, we were very happy," explains Magdalena.

This simple experiment gave her all the proof she needed to start using improved postharvest storage technologies like the PICs bags.

"Any doubts that I had about using the bags were erased at that moment. The experiment reinforced my belief in what our trainers from the Africa RISING NAFAKA Project kept telling us all along, that the bags were going to stop damage by weevils and that we would fetch great prices for our produce after storing it for a long time," notes Magdalena.

For most rural smallholder farmers, poor storage and handling of harvests result in significant food loss and nutritional value, pose serious health hazards if linked to the consumption of aflatoxins, and poor quality grains lead to fewer marketing opportunities as the damaged grains fetch low prices at the market.

Magdalena is aiming to repeat this success. In June 2017 she harvested 37 bags of maize, out of which she stored 33 in PICS bags. A directive issued by the Tanzanian government in June to restrict grain trade across Tanzanian borders threatened to derail her plans, but the restrictions from the directive have since been lifted (in mid-November). She therefore hopes the market prices will start picking up and she will be able to sell her stock at a premium price so that she can recoup her investment of buying 30 more PICS bags.

Magdalena Haule with her stored maize. Photo: C. Mutungi/IITA.

"I am not happy so far, but believe that things are going to pick up soon. At the moment we are selling 1 kg at TZS 350 (USD 0.15) for well-stored grains like mine, while the damaged grains are selling at TZS 260 (USD 0.11). So far, I have sold only 10 out of my 33 bags because I would like to keep the rest and see how things will turn out in January/February 2018," she says.

Magdalena believes that using PICs bags has empowered her as a farmer. She can now confidently store her grains for later consumption by her family, while the surplus can also fetch her a fortune at the markets when the price is right.

The findings of a recent economic assessment study by Africa RISING scientists in Babati and Kongwa districts of Tanzania affirms Magdalena's projections about what she will earn. According to the study, PICS bags are profitable when the grain is sold during the lean season. The mean net return ranges from USD15/t in Babati to USD40/t in Kongwa. This means that a farmer earns the financial equivalent of 3 extra bags of maize for every 10 bags stored.

"Storing maize using PICS bags will have a substantial positive impact on household food security, especially among net-buyer farm households enabling them to reduce their annual grain deficit period by three to four weeks. Moreover, market-oriented storage using improved storage can increase farmers' income by up to USD14/person when they use PICS bags," explains IITA Agricultural Economist Bekele Kotu who led the study.

Magdalena and her fellow PICS bag revolutionaries in Itumpi Village are beneficiaries of the USAID Tanzania Mission funded Africa RISING–NAFAKA Project. This partnership project focuses on delivery and scaling of promising interventions that enhance agricultural productivity in Tanzania. Its key interventions include promotion of climate-smart agricultural innovations, dissemination of best-bet crop management packages, rehabilitation and protection of natural resources, and reduction of food waste and spoilage. The Africa RISING–NAFAKA project focuses on three crop enterprises—maize, rice, and legumes with nutrition and postharvest handling as cross-cutting themes.

"Stored grain is now a major gain": Farmers from two villages in Tanzania's Mbozi District tell of the impact of low-cost, postharvest technologies on their lives

Over the past four years, the Africa RISING–NAFAKA project has been working with smallholder farmers in the southern highlands of Tanzania to improve the productivity of maize and legumes through the introduction of improved seed varieties coupled with capacity building on good agricultural practices. The results of this work have been impressive with many farmers now doubling (and in some cases tripling) their yields, especially for maize which is a staple food in Tanzania. However, an increase in productivity alone has been shown not to be in and of itself the answer to achieving food security. Studies have shown that even after growing improved crop varieties and bumping up their production, smallholder farmers still lose 30% or more of their grain harvest due to poor postharvest handling and storage.

These losses decrease the amount and quality of available food stocks. For many families, such losses are a threat to household food and nutrition security, and food safety. For other farmers such losses affect profitability and household incomes. These losses mostly occur during two stages of postharvest handling—preliminary processing and storage. As a response, the Africa RISING–NAFAKA project introduced farmers to three improved, low-cost postharvest technologies—mechanical threshers, collapsible drier envelopes, and air-tight storage bags. For many farmers, these technologies have changed the outlook of their postharvest season for the better. Women and children, for example, no longer have to spend several hours on end manually threshing maize, and neither do the men have to endure the disappointment of spoilt grain after a few months of storage, signaling another food insecure couple of months for the family.

During recent follow-up visits to Iwalanje and Nasama villages in Mbozi District, Mbeya Region in the southern highlands of Tanzania, farmers recounted the impact the low-cost, postharvest technologies are having on their lives.

Elixavery (front) and some members of the nine producer groups in Nansama Village look at maize they have stored in the village warehouse since 26 August 2017 as part of project demonstrations on the efficacy of PICS bags . Photo credit: Jonathan Odhong'.

Elixavery Mwalembe is the secretary of a network of nine producer groups that have worked with the Africa RISING–NAFAKA project in Nansama Village since 2016. The groups are: Nansama Women Group, MAKU Group, Nansama AMCOS, Iganda AMCOS, Vijana Nansama, Mboga na Mamtunda, Nansama Uboreshaji, Hanzundila Group, and Tuinuane Group. With a membership of 600 (211 women and 389 men), the groups are involved in various activities that include collective aggregation and marketing of produce, savings and credit schemes for members, and collective procurement of farm inputs.

"Thanks to these postharvest technologies, we have improved the quality of maize that we sell to the market and reduced postharvest losses immensely by applying the knowledge on improved postharvest handling. We spend less time and labor shelling and drying maize," explains Elixavery.

"With the mechanical sheller, we are able to thresh up to 50 bags (5 tons) of maize per day compared to 5 bags when the operation is done manually. The cost of shelling has also reduced significantly from TZS 1000 to 700 TZS for every 100 kg. In addition, we are able to generate income by offering threshing services to other farmers," he adds.

In the 2016/2017 postharvest season, 110 farmers (70 men, 40 women) used the threshing machine in Nansama village. In total, 57.5 tons of grain were shelled and earnings amounting to TZS 402,500 realized. The groups have invested this money in a savings and credit program for the members. They also have plans to acquire a threshing machine with higher a capacity to ensure that they can provide the services to more farmers in a day; this means more income for the group.

"After threshing, comes storage. And many farmers in this village have adopted air-tight storage," notes Elixavery.

"Through demonstrations in which we stored our maize harvests for 6 months or more in the community warehouses, we have seen that the technologies protect stored grain from insect pests with no need for insecticide," he adds.

After several months of storage, grain in hermetic bags is still clean and safer since no chemical has been applied. The farmers are also now realizing how storage of seed in PICs bags is also giving them an edge at the market. During the 2017/2018 storage season, 181 farmers who are members of the various groups stored 44.2 tons of maize in hermetic PICS bags (equivalent to 442 bags).

"Our biggest challenge at the moment is linkage to markets; low grain prices are a reality that, as farmers, we have to contend with, but we can do something about it by using PICs bags," explains John Mamuya, an agricultural extension officer in Iwalanje Village and one of the beneficiaries of the technologies.

John narrates how the 2017/2018 postharvest season provided a case study for the prevailing market demand for grain stored in PICS bags:

"Farmers in this village stored 9 tons of maize in hermetic bags in the village warehouse. This was only a fraction of the total volume of grain harvested by farmers; the rest of the grain was sold immediately after harvest or stored in ordinary bags admixed with insecticide (per typical farmer practice).

"In October 2017 when the National Food Reserve Agency (NFRA) announced that they would be buying maize from our locality, the conditions, were that the grain be accessible from a centralized place and not treated with insecticide," explains John.

"When they saw the grains we had stored in the PICs bags, they were amazed and that is all they now wanted, " adds John. The maize stored in PICs fetched nearly double the prevailing market price for ordinarily stored maize.

"The selling price for our PICS bag stored maize was TZS 500 per kilogram compared to a price of between TZS 220 and 280 for maize stored in ordinary woven polypropylene bags with insecticide," intimates John.

In years past, only relief agencies such as the WFP would place conditions on quality of produce they would purchase, but now it seems that the Tanzania government has added this extra safety/quality assurance requirement for all the grain being bought to replenish the national food reserves. John anticipates that in the future these safety assurance requirements will only increase in the coming years, with members of the private sector also demanding the same. He therefore feels that farmers need to be ahead of the curve by adopting PICS bags even more. So far, according the local agro-dealer in Iwalanje village, about 400 hermetic bags were purchased by individual farmers (some purchasing as many as 50 bags) during the 2017/2018 postharvest season. This is a good trend that John hopes will continue as more and more farmers realize the benefits of these postharvest technologies.

Members of a producer group in Nansama Village during a meeting to discuss the sale of stored grain.

Having an improved rice variety without applying good agricultural practices is like having a bicycle with a flat tire

Neema Hussein at her paddy farm. Photo credit: ARI Dakawa.

It has been a long winding road to rice paradise for Neema Hussein, a rice farmer from Mbarali District in the Southern Highlands of Tanzania. But she is now getting there. Finally, she can smile as her rice harvest keeps improving year after year.

In 2009, Neema decided to grow an improved rice variety to improve her production (higher yields) and to benefit from other advantages like disease resistance and resistance to lodging. Her variety of choice was the SARO 5 (TXD 306). Her optimism for a quick change in fortunes quickly turned to despair that would last for 6 years as she only noticed a marginal change in her harvest.

"I used to harvest between 7 and 15 bags (each bag weighing 125 kg) from my 3-acre rice paddy when I was growing Kalamata, a local rice variety. Then in 2009, when I switched to SARO 5 (TXD 306) and my yield increased to about 30 bags for the next 6 years, I was disappointed because I could not reach the potential yield of 120 bags," notes Neema.

"I didn't know what I was doing wrong, but I kept growing the improved rice variety since what I harvested was still much better than what I would get if I grew the local varieties," she adds.

It was not until she joined the Africa RISING-NAFAKA project rice productivity enhancement trainings (led by ARI Dakawa) during the 2015/16 cropping season that she "uncovered" the golden secret to higher yields.

"Having an improved rice variety without applying good agricultural practices (GAPs) is like having a bicycle with a flat tire," she quips.

She explains the changes she has observed.

“Since I started to complement growing the improved rice variety with GAPs like levelling land before planting, applying fertilizers, applying correct spacing etc., my yield has been increasing year after year. In 2016, I harvested 75 bags, and 90 bags in 2017!” she adds with an distinct smile on her face.

With this positive trend, the sky is the limit for Neema. She is now more determined and ambitious, and hungry for more success.

“My aim is to raise my yield to over 100 bags. If I can reach that target and make a good profit from sales, then I plan to purchase a power tiller,” she says.

Neema’s dreams are valid. And so are those of 1,125 smallholder farmers in the southern highlands of Tanzania that are currently being introduced to improved rice varieties like SARO 5 (TXD 306) and being trained on good agricultural practices for rice production.

The SARO 5 (TXD 306) rice variety has a yield potential of 40 bags per acre. And if the markets are favorable, Neema may just be in for a good pay day. In 2017 the prevailing market price for a bag of paddy was TZ 150,000 (USD 67.5), therefore her yield was worth TZS 13,500,000 (USD 6,075).

Resources: Africa RISING – NAFAKA Project Compendium of Rice Production Training Protocols